

A NEW SPECIES OF SILIQUA (PELECYPODA) FROM WESTERN NORTH AMERICA

By LEO G. HERTLEIN

During the course of dredging off the coasts of California and Alaska, specimens of a *Siliqua* were obtained by Dr. G. Dallas Hanna which did not seem referable to either *S. lucida* or to the young of *S. patula*. The coloration of the shell, together with the fact that their habitat was in moderately deep water in comparison to the coast-inhabiting *Siliqua patula* and *S. lucida*, suggested that they represented a distinct form. Such proves to be the case and it is here described as a new species.

The genus *Siliqua* has been reported in California in strata of late Cretaceous¹ age, and from late Miocene to Recent. A synopsis of the Recent species of North America and the Antilles was published by Dall².

The writer wishes to acknowledge the assistance and advice given by Dr. G. Dallas Hanna, Curator of the Department of Geology, California Academy of Sciences, and Mr. A. G. Smith, Research Malacologist in the same institution. Dr. I. McT. Cowan, Department of Zoology, University of British Columbia, furnished specimens and information concerning their occurrence in British Columbia. Photographs used in the present paper were prepared by the late Frank L. Rogers.

Key to the Recent West American species of *SILIQUA*.

- A. Internal radial rib sloping anteriorly..... *patula*
- B. Internal radial rib sloping nearly vertically:
 - a. Adult shell large, high, thick, usually exceeding 40 mm. in length..... *alta*
 - aa. Adult shell, small, very elongate, thin, usually not exceeding 40 mm. in length
 - b. Posterior end squarish..... *lucida*
 - bb. Posterior end elliptical..... *sloati*

(1) *Siliqua alisoensis* Packard, Univ. Calif. Publ., Bull. Dept. Geol. Sci., Vol. 13, No. 10, p. 427, pl. 34, fig. 2, June 30, 1922. "Chico group, *Tellina ooides* zone," late Cretaceous, in Santa Ana Mountains, Southern California.

(2) See Dall, W. H., "Synopsis of the Solenidae of North America and the Antilles," Proc. U. S. Nat. Mus., Vol. 22, No. 1185, pp. 107-122, October 9, 1899 (*Siliqua*, p. 109.).

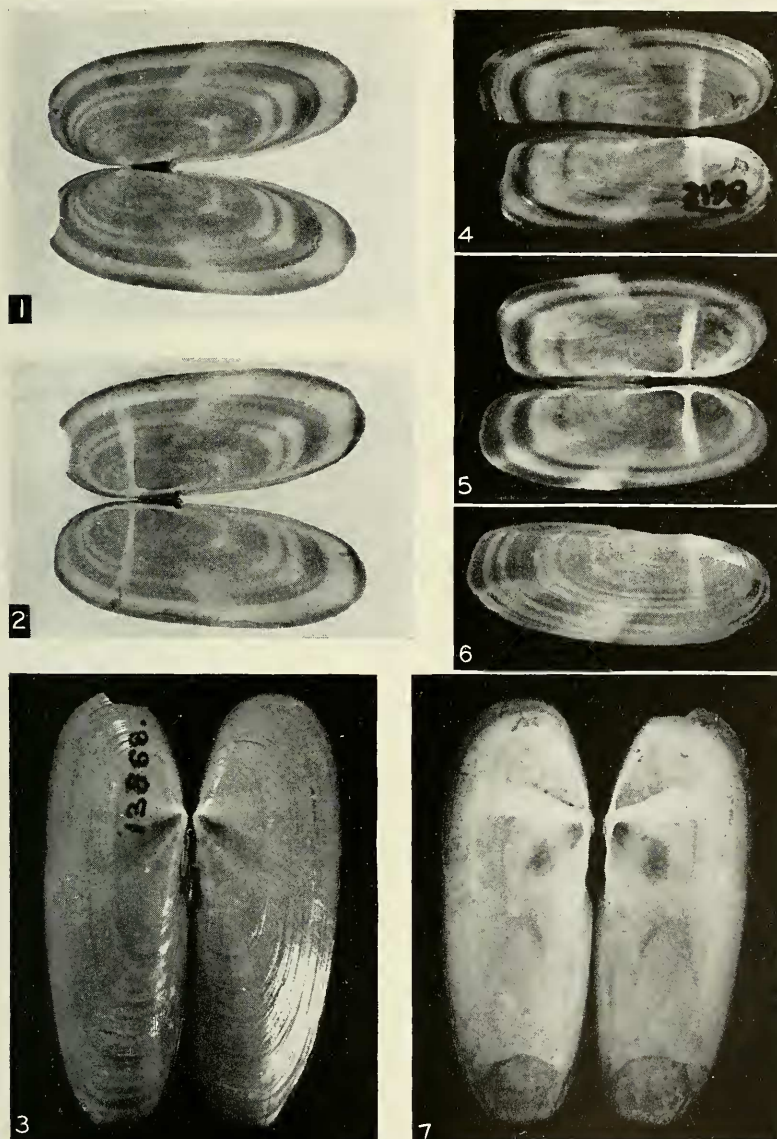


PLATE 5

Explanation of Figures

Figs. 1, 2. *Siliqua sloati* Hertlein, new species. Holotype, from off Laguna Point, Mendocino County, California; length, 35 mm. 1. View of exterior. 2. View of interior. Figs. 3, 7. *Siliqua patula* Dixon. From Morro Bay, San Luis Obispo County, California; length, 46 mm. 3. View of exterior. 7. View of interior. Figs. 4, 5, 6. *Siliqua lucida* Conrad. From breakwater at North Island, Los Angeles County, California. 4. View of exterior; length, 30.9 mm. 5. View of interior of same specimen. 6. View of exterior of a right valve; length, 32 mm.

***Siliqua sloati* Hertlein, new species**

Plate 5, Figs. 1, 2; Plate 6, Figs. 4-7

Shell elongately oval, thin; beaks situated at about one-fifth the length from the anterior end which is ovally rounded; posterior to the beaks the shell gradually curves toward the posterior end which is rather acutely rounded; exteriorly the shell is beautifully polished and ornamented by concentric oval brownish bands on a cream colored background; interior as in *Siliqua lucida* with the internal rib sloping nearly vertically to the ventral margin. Length, 35 mm., height, 12.2 mm., convexity (both valves together), approximately 5 mm.

Holotype (Calif. Acad. Sci. Paleo. Type Coll.), from Loc. 31156 (C.A.S.), 356° 2.8 miles off Laguna Point, Mendocino County, California, dredged in 46 to 49 meters (25½-27 fathoms); G. Dallas Hanna, collector, August 6, 1940. Paratypes (Calif. Acad. Sci. Paleo. Type Coll.), from Loc. 28545 (C.A.S.), at point where line W. ¾ S. from Pt. Bonita, California, crosses the 55 meter (30 fathom) line; G. H. Clark and G. D. Hanna, colls., April 29, 1936.

Additional specimens, the largest 40 mm. long, were dredged in northern California. Dr. I. McT. Cowan presented two specimens which were dredged in 18 meters (10 fathoms) in Plumper Sound, Saturna Island, British Columbia. He also mentioned (written communication) that this species was dredged in Georgia Strait, British Columbia, in 22-82 meters (12 to 45 fathoms) on a muddy bottom. One specimen was dredged by Dr. G. D. Hanna in Portage Bay, Alaska, in 31 meters (17 fathoms).

Range: Portage Bay, Alaska, to Point Bonita, Marin County, California, in 18 to 157 meters (10 to 86 fathoms).

This new species differs from *Siliqua lucida* Conrad³ in that the posterior end is more pointed, the posterior dorsal area is less expanded, more curved and not bordered by a distinct groove, and the exterior of the shell is highly polished and ornamented by bright colored bands of brown and cream in comparison to the subdued brownish and purplish color of *S. lucida*.

(3) *S[olecurtus]. lucidus* Conrad, Jour. Acad. Nat. Sci. Philadelphia, Vol. 7, p. 231, pl. 17, fig. 8, 1837. "Inhabits the sand beach, near Sta. Barbara, uncommon." Also illustrated by I. S. Oldroyd, Stanford Univ. Publ. Univ. Ser. Geol. Sci., Vol. 1, p. 189, pl. 52, fig. 2, 1924 (as *Siliqua lucida*). Monterey, California, to Todos Santos Bay, Lower California. Also in the Pleistocene at San Pedro and San Diego, California — Grant and Gale, Mem. San Diego Soc. Nat. Hist., Vol. 1, p. 389, pl. 21, fig. 6, 1931 (as *Siliqua lucida*). Earlier records cited. Pliocene to Recent.

Compared to the young of *Siliqua patula* Dixon⁴ the new species is less elongate, the beaks are more anteriorly situated. It also differs in the decided color banding exteriorly and in that the internal rib is smaller and usually extends to the ventral margin in nearly a vertical line rather than sloping anteriorly.

This new species differs from juvenile forms of *Siliqua alta* Broderip and Sowerby⁵ in the more elongated, thinner, more highly colored shell, thinner internal riblet and in that the pallial sinus is narrower and extends forward from the posterior adductor impression before descending.

This new species is named for Lewis Warrington Sloat⁶ one of the founders and first secretary of the California Academy of Natural Sciences.

The anatomy of three individuals of the new species was studied by the late Dr. Harold Heath. Two have a shell length of 34 mm. and the third specimen, of approximately the same size, had been removed from the shell. The first two were taken off Laguna Point, Mendocino County, California, in 46 to 49 meters (25.5-27 fathoms); the other came from a depth of 155 to 157 meters (85-86 fathoms), off Mad River, Humboldt County, California. Specimens of *Siliqua patula*, with whose anatomy that of *S. sloati* was compared, were collected at Pismo Beach, California, and range in length from 32 to 116 mm. Unfortunately no preserved specimens of the anatomy of *S. lucida* were readily available to enable Dr. Heath to make a comparison with that species.

Dr. Heath gave the following discussion of his study of the anatomy of the two species.

Externally *S. patula* and *S. sloati* resemble each other closely, but there are significant differences. One difference is the degree of pigmentation. In *S. patula* all traces of pigment are lacking or are confined to the bases of the few papillae surrounding the siphonal openings. In the new species, taken from a depth of ap-

(4) *Solen patulus* Dixon, Voyage Round the World, p. 355, fig. 2 [two figs.], 1789. "At the mouth of Cook's River," northwest coast of America [Alaska]. — I. S. Oldroyd, Stanford Univ. Publ. Univ. Ser. Geol. Sci. Vol. 1, p. 190, pl. 48, fig. 1; pl. 52, fig. 1, 1924 (as *Siliqua patula*).

(5) *Solen altus* Broderip and Sowerby, Zool. Jour., Vol. 4, No. 15, p. 362, 1829. "Hab. in Oceano Arctico." — I. S. Oldroyd, Stanford Univ. Publ. Univ. Ser. Geol. Sci., Vol. 1, p. 190, pl. 47, figs. 1, 2, 1924 (as *Siliqua patula alta*). "Swikshak Beach, Alaska."

(6) See Hertlein, L. G., "Lewis W. Sloat Pioneer Conchologist in California," Amer. Malacol. Union 25th Anniversary Issue. Ann. Repts. 1956 (Bull. No. 23), pp. 7-8, December 31, 1956.

proximately 155 meters (85 fathoms), pigment is lacking entirely. In the two from shallower water the siphons and sensory papillae fringing the mantle border are provided with a brownish pigment, and the foot also is blotched with the same material.

It is worthy of note that in the deeper water individual the mantle papillae, along the front margins of the shell, are greatly reduced, and the siphon surface is as smooth as in *S. patula*. In the other two specimens the papillae are as prominent as in *S. patula*, and the siphons are provided with what evidently are sensory outgrowths (Pl. 6, Fig. 5). Obviously, the presence or absence of these structures is correlated with the amount of light, which conceivably may act as a developmental stimulus.

The musculature of these species is altogether too resistant to permit of a detailed dissection. However, it may be said that the pedal protractors originate as paired bundles in the neighborhood of the anterior shell adductor, and, although their component fibers appear to merge, they nevertheless are distinct throughout. Those of the group adjacent to the adductor form in part the lateral wall of the visceral cavity, while others radiate more ventrally and enter into the formation of the median and more posterior divisions of the foot. The other member of this pair extends into the more anterior portion of the foot, and in both species their radiating fibers evidently cooperate with intrinsic circular muscles in decreasing the caliber of the foot, thus causing its extension.

In this process of extending the foot the transverse muscle bundles bridging the visceral cavity also may play a part. Their contraction obviously must constrict the pedal sinuses, and if the

Explanation of Figures on Plate 6

Fig. 1. Lateral view of stomach and digestive gland of *Siliqua patula*. Shell length, 116 mm.

Fig. 2. Right half of body of *Siliqua patula*, showing internal features of stomach, arrangement of pedal protractors and of the muscles spanning the visceral cavity. Shell length, 32 mm.

Fig. 3. Lateral view of the digestive system of *Siliqua patula*. Shell length, 116 mm.

Fig. 4. Lateral view of the digestive system of *Siliqua sloati*.

Fig. 5. Siphon of *Siliqua sloati*, from 46 meters (25 fathoms).

Fig. 6. Right side of stomach of *Siliqua sloati*.

Fig. 7. Right half of body of *Siliqua sloati*.

Fig. 8. Right lateral view of stomach of *Siliqua patula*. Shell length, 32 mm.

Fig. 9. Dorsal view of main organs of *Siliqua patula*. Shell length 55 mm.

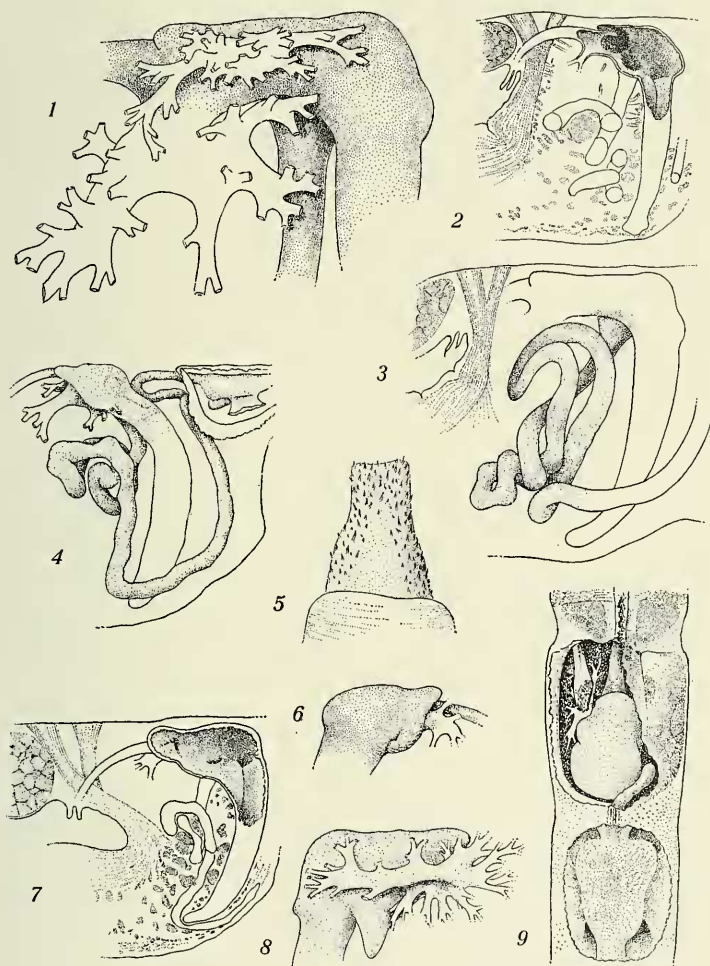


PLATE 6

The explanations of figures and the line drawings used for illustrations on this plate were prepared by the late Dr. Harold Heath.

contained blood is forced anteriorly it produces a forward extension of the foot. It is important to add that here, as in several other genera, the arrangement of these muscles constitutes an important item in the list of specific differences.

Fundamentally the digestive system in both species is constructed upon the same plan. There are, however, several obvious differences. The esophagus in each is dorso-ventrally compressed to some extent, is of essentially the same diameter throughout, and in most instances the inner epithelial lining is marked by delicate longitudinal grooves.

Among what appear to be the more primitive pelecypod families, the stomach comprises two divisions, a dorsal and ventral section. Ducts from the digestive gland open into the dorsal division, and the crystalline stile secretion is developed by the lining cells of the lower portion. In *S. patula* the upper region is typical, whereas the lower section no longer is continuous with the intestine, but has become fashioned into a capacious diverticulum. The intestine therefore directly unites with the upper division.

The configuration of the stomach proper is similar in both species. The chief differences being those of proportion. One striking variation appears in relation to an out-pouching from the right side of the gastric wall. In *S. patula* (Pl. 6, Fig. 8) it is a conspicuous plain-walled structure; in *S. sloati* it is situated more anteriorly, is relatively of small size and its lining is fashioned into several distinct folds. Developmentally the bile ducts originally were doubtless paired, and this condition persists in *S. sloati* (Pl. 6, Figs. 4, 6). In *S. patula* (Pl. 6, Figs. 1, 8) the main duct of the right hand gland is single; the left, on the other hand, has a single duct with ventral opening, and more dorsally there may be one or several connections.

The diverticulum responsible for the crystalline stile secretion is a plain-walled structure in both species. In primitive pelecypods, where the lower division of the stomach is attached directly to the intestine, a longitudinal groove is reported to be the channel whereby nutritive material is passed along to the intestine. In the genus *Siliqua* the same groove persists (Pl. 6, Figs. 2, 7), but obviously, if originally it constituted a transportation feature, it no longer carries on the same function.

The intestine in the two species differs with respect to relative length and in the arrangement and disposition of the coils. With the exception of slight variations the general plan in *S. sloati* is that represented by Plate 6, Fig. 4. In all specimens of *S. patula*, with a shell length ranging from 32 to 116 mm., the condition of affairs is shown on Plate 6, Fig. 3. Evidently, therefore, these differences are not due to size or age differences, and furthermore the position of several of the transverse muscle bands precludes the

shifting to any considerable degree of the intestinal tract. It may be added that the intestine penetrates the heart.

The gonads of specimens of *S. patula* taken in early June contain fully developed eggs; those collected in late summer evidently had passed the breeding season. In this last named collection the reproductive gland presents essentially the same appearance as in the case of individuals of *S. sloati* dredged in the month of August. It therefore is difficult to determine whether this last named species is represented by adult individuals. No sections were made of the gonad or kidney of either species, and their relations to each other are unknown.

The pericardial cavity is single, no dorsal or ventral septum being present. The general position of the organ is represented on Plate 6, Fig. 9.



POPULATIONS OF THE BUTTERFISH, *PORONOTUS TRIACANTHUS* (PECK), WITH SYSTEMATIC COMMENTS¹

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ABSTRACT

Examination of large series of butterfish from throughout their range revealed three major populations: a deep-bodied form in the Gulf of Mexico; an intermediate form in Western Atlantic waters of 12 fathoms or less south of Cape Hatteras; and a generally shallow-bodied form in Western Atlantic waters north of Hatteras and south of Hatteras beyond 13 fathoms. *Peprilus burti* Fowler is placed in the synonymy of *Poronotus triacanthus* (Peck).

INTRODUCTION

The butterfish, *Poronotus triacanthus* (Peck), a fish of the family Stromateidae, constitutes an important human food and sport resource in parts of its range, particularly in New England

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